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(54) A protective arrangement against current overloading with direct fuse coupling to a cable termination.

(57) A protective arrangement against current overloading, in particular for motor vehicle electric systems, with direct fuse coupling to a cable termination, wherein at least one fuse (69) terminal is placed in direct electric connection contact with a cable termination (70), thereby reducing the number of the series contact connections in the arrangement, and consequent voltage drop and power dissipation.

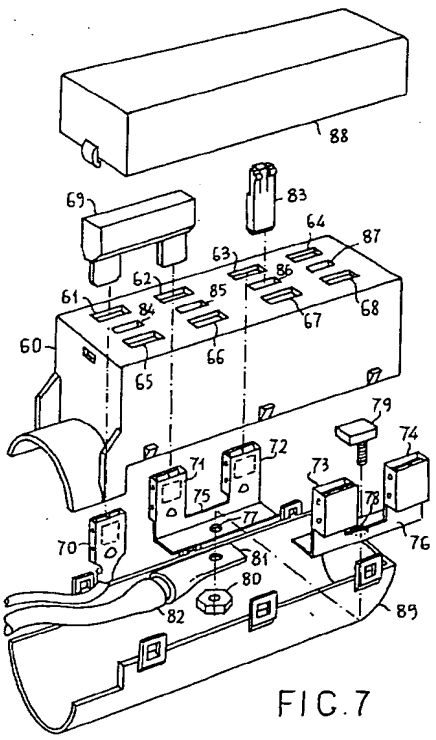

FIG.7

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The present invention relates to a protective arrangement against current overloading, with direct fuse coupling to a cable termination, particularly for motor vehicle electric systems. It is a known fact that prior art electric systems for motor vehicles, automobiles, trucks, tricars, and self-propelled construction machines, are provided with a capillary protection of their electric functions using fuses housed in a fuse box so as to form an electric power distribution unit.

The distribution unit is powered through a cable of appropriate conduction cross-section, and in turn powers, in cascade through a plurality of fuses having a suitable amperage, a plurality of electric apparatus, such as headlights, tail lights, parking lights, fans, windshield wipers, etc.

In the event of a short or unacceptably protracted overloading of such apparatus, the fuse ahead operates to prevent dangerous overheating and destruction of the protected apparatus while also providing protection from fire hazard.

This is specially important with vehicles operating on inflammables, mainly gasoline, and its importance is stressed by that modern cars frequently come equipped with fuel pumps and appropriate plenums to keep their fuel systems pressurized.

In such circumstances, fire caused by shorts or overheating may have disastrous effects.

The distribution units employed provide reasonable but not full protection from such hazard.

In fact, the vehicle electric system includes a multiplicity of large supply cables extending ahead of the distribution unit and being unprotected from shorts.

These cables are basically arranged to connect the battery to the electric starter, the junction box, and the charging alternator.

In a manner related to the specially large loads they are to power, the cables have large cross-sections, and are kept permanently live and usually left unprotected.

For this reason, in the event of a short occurring, and in the continued presence of large amounts of energy in the battery, overheating may be experienced with its attendant fire hazard and no apparatus provided to take actions.

Attempted extensions of the protection against overcurrents to the battery side of the electric system clash with the large power dissipations and voltage drops that occur in any electric connection scheme upon breaking the physical continuity of the conducting elements and where the electric contact is ensured by the juxtaposition of the elements being maintained by a contact force.

From this point of view, whereas an electric contact resulting from a crimping operation (that is, crimping to strain) for applying cable terminals to cable conductors has a very low and negligible contact resistance, and after an initial settling period substantially unvarying conductivity over time, an electric contact provided by clamps has a much higher resistance and, what is more important, considerable variability over time, especially in the presence of vibration and temperature variations apt to result in gradual loosening and decreased contact pressure.

Even higher is the contact resistance of so-called "friction" releasable connections, unless adequate contact pressure and surface area for the currents to be carried can be ensured.

These factors have discouraged the adoption heretofore of protection against shorts for large loads.

In fact, the voltage drop brought about by intervening safety apparatus is due not only to the contacts between fuse terminations and connectors in the fuse housing box but also to the connections between the fuse housing box and the supply cables.

Thus, there occur something like four contact voltage drops in series within a limited space which may be the cause for large power dissipation and result in local overheating.

The problem is intensified by that the protections must be installed in the engine compartment, wherein the ambient temperature may attain large values to be estimated at 80 °C by accepted standards.

To gain an idea of the problem, it may suffice to consider that even a very small contact resistance of 5 mohm through which a current of 100 A is passed would produce a voltage drop of 0.5 V and a power dissipation of 50 Watts.

Where four contact resistances are in series with one another, the price to be paid for the protection, and how the protection may introduce added hazard, can be fully appreciated.

Such drawbacks are obviated, at least in part, by the protective arrangement against current overloading, with direct fuse coupling to a cable termination, forming the subject matter of the present invention, whereby the number of the serial connections of the friction or clamp type is cut down from four to at least three, and in the extreme just two.

According to another aspect of the present invention, where a single supply cable is to power several loads individually protected by a fuse, the supply parallel is integral with the friction contacts for the fuses.

According to a further aspect of the present invention, the friction contacts for the fuses, whether they are integral contacts to cable terminals or to elements in parallel, are constructed to provide a flat terminal with a friction contact having three pressure spots opposedly arranged to ensure a

large surface area of contact with both faces of the flat terminal, and therefore, minimal contact resistance.

According to yet another aspect of the present invention, the pressure contacts for the fuses, made integral with cable terminals, are housed removably within a fuse housing box to allow not only removal of a fuse but also removal of the pressure contacts for inspection and servicing as required, as well as easier installation of same.

According to a further aspect of the present invention, the cable terminals which form the friction contacts for the fuses are, when made removable, protected by an insulating shell to prevent their removal from the fuse box from causing unintentional shorting to metal parts of the vehicle.

The features and advantages of the invention will be more clearly apparent from the following description of a preferred embodiment thereof and the accompanying drawings, in which:

Figure 1 shows schematically fuse cutout arrangements according to the prior art;

Figure 2 shows schematically a protection arrangement according to the present invention;

Figure 3 shows schematically a modification of the protection arrangement according to the present invention with direct connection of a terminal from several fuses to a single connection element;

Figure 4 is an exploded perspective view of a preferred embodiment of a cable termination for direct connection to the fuse terminal in the arrangements of Figures 2 and 3;

Figure 5 is a view of the cable termination shown in Figure 4, taken along a different direction;

Figure 6 is an exploded part-sectional view of a cable termination as protected by an insulating case for the protection arrangements of Figures 2 and 3;

Figure 7 is an exploded perspective view of a preferred embodiment of a protection arrangement according to the present invention.

With reference to Figure 1, which illustrates the state of the art, it is current practice to house the fuses such as 1 within an insulating box carrier 2 provided with elastic contact elements, usually of phosphor bronze, 3, 4 for contact with the fuse 1, at one end, and cables such as 5, 6, at the other.

The contact between the elements 3, 4 and the cables is not a direct one, but obtained instead with the interposition of cable terminals 7, 8, usually made of either phosphor bronze or copper and crimped onto the cable, and friction fitted over terminations 9, 10 of the contact elements 3, 4.

Alternatively, the terminals 7, 8 of the eyelet type may be connected to the terminations 9, 10 by a clamp screw.

The fuse shown in Figure 1 is a cylinder type with conductive ends, but it should be appreciated that the scheme would apply to fuses of another type just as well.

The diagram shows that in powering a load through the protection arrangement, voltage drop and power dissipation appear in four areas, namely:

1. At the contact between the terminal 7 and the termination 9,
2. At the contact between the element 3 and the fuse,
3. At the contact between the fuse and the element 4,
4. At the contact between the termination 10 and the terminal 8.

By contrast, Figure 2 shows schematically the protection arrangement forming the subject matter of the present invention; the cables 5, 6, or at least one of them, are/is terminated with suitably shaped crimp-on terminals, housed within the fuse carrier 2, which directly form friction contacts with the terminals of the fuse 1.

In this way, the number of the friction contacts is reduced to just two, which is advantageous in terms of decreased power dissipation and voltage drop.

In addition, by taking special measures in the construction of the contact terminations, the contact resistance between the terminations and the connector can be minimized.

Figure 3 shows schematically a protection arrangement wherein a plurality of fuses 11, 12, 13, 14 are supplied from a paralleling element 15 which itself forms terminations 16, 17, 18, 19 of contact with one terminal of the fuses, the other terminal of the fuses being in contact with a termination 20, 21, 22, 23 of one from a plurality of distribution cables 24, 25, 26, 27.

The paralleling element 15 is provided with an eyelet 28 for screw coupling to an eyelet terminal of a supply cable.

Figure 4 is an exploded perspective view of a preferred embodiment of a cable termination for direct coupling to a fuse terminal.

The latter is preferably a blade fuse commensurate to the current flow involved of about 40 to 100 A.

The cable termination basically consists of a prismatic element formed by bending from a flat sheet blank, preferably of phosphor bronze or more generally a material with high electric conductivity, which has a rectangular wall 27, two sides 28, 29, and a contact comb 30 opposite to the wall 27 and suitably S-shaped to provide a lead-in for insertion of a fuse terminal, between the wall 27 and the comb 30.

The insertion, e.g. of the terminal 31 of the fuse shown schematically at 32, is effected along the arrow direction.

Punched through the sides 28, 29 are openings 31, 32, 33, 34 intended for receiving engagement teeth which are dimpled out of corresponding sides 35, 36 of a bias element 37 made of stainless steel, for example, which is also provided with an elastic pressure comb 38 effective, in the coupled condition of the bias element to the termination, to exert a suitable pressure on the reeds of the comb 30 to have them pressed against the wall 27.

It can be appreciated, therefore, that the contact between the fuse 31 terminal and the cable termination will occur simultaneously with the wall 27 and the reeds of the comb 30 on account of the pressure exerted by the bias element.

Contact occurs on both faces of the terminal 31 and on at least three spots of same, even where the terminal surfaces are not truly flat, thereby providing an adequate contact cross-section for the currents to be carried and minimal contact resistance by virtue of the electric conduction function being separated from the mechanical one providing contact pressure, which pressure may be obtained from materials having adequate mechanical characteristics even though their conductivity is low.

The remote end of the prismatic termination from the inserted one is fashioned into two securing tabs 39, 40 which are crimped, one onto the conductive end of the cable and the other onto the insulating cable sleeve, thereby ensuring a stable electric contact of negligible resistance, strong, and unaffected by vibration and temperature changes.

Figure 5 shows in perspective the completed cable termination, as viewed along a different direction from that of Figure 4 to bring out a dimpled contact area 42 in the wall 27.

This area provides a stable contact surface opposite to the contact comb 30.

Also on the wall 27, a tooth 41 is dimpled out which is intended to engage the cable termination to an insulating protection case.

This case may be formed directly in the fuse carrier, or may be an insulating protection case removable from the fuse carrier.

The latter alternative is illustrated in Figure 6.

Figure 6 is a side view of a cable 43 termination, of the same type as previously described, an insulating protection case 44, shown in section, and a locking element 45.

The protection case 44 is made of an insulating material such as a reinforced plastics and comprises a prismatic element with a square or rectangular cross-sectional shape containing a first prismatic housing 51 with a rectangular cross-sectional shape for the termination 43 and a second prismatic housing 52 with a rectangular cross-sectional shape for the locking element 45.

The two housings are separated by a diaphragm 46 on which a spring tab 47 is formed which has engagement teeth 48.

The diaphragm 46 has a recess 49 on its side facing the housing for the locking element 45.

The termination 43 is inserted along the arrow 50 direction into the housing 51 until its end comes to bear onto a shoulder stop 53 in the case.

On inserting the termination 43, the raised tooth 41 will interfere with the tooth 48 causing the tab 47 to deform elastically toward the housing 52.

With the termination 43 fully in, the tab 47 will return to its rest position and the tooth 48 engage the tooth 41 to prevent the termination from coming out of the case 44.

To provide double protection from the risk of the termination slipping off, the locking element 45 is fitted, along the arrow 54 direction, into the housing 52, wherein it will be retained by at least one pip 55 carried on a spring tab 56 of the element 45 snapping into the recess 49.

The locking element 45, once inserted into the housing, will prevent the tab 47 from being deflected toward the housing 52 and ensure unreleasable engagement of the two teeth 41, 48.

It should be noted in this respect that an opening cut through the wall 27 could be substituted for the tooth 41.

A wall of the case 44 has an opening 56, or just a recess, adapted to provide a seat with engagement edge for a serrated element, similar to the tab 47, which would be provided preferably on a socket formed in the body of a fuse carrier intended to receive the insulating case 44 and to house one or more fuses and more cable terminations.

The case 44 is preferably provided, on an outward wall thereof, with an elongate rib 57 for keying the insertion of the case into its corresponding socket in the fuse carrier.

The insulating case 44 prevents the termination 43 from inadvertently contacting metal parts in the event of the case 44 becoming separated from the fuse carrier.

It can be appreciated that if the cables are not required to be separated from the fuse carrier, a plurality of cases like the one described could be made integral with the fuse carrier used to receive a number of terminations like the termination 43, each for direct connection to a fuse terminal.

As a preferred embodiment of this kind, Figure 7 shows an exploded perspective view of a fuse carrier assembly for accommodating four fuses powered from a paralleling element.

The assembly comprises a body 60 made of a reinforced plastics material provided with a plurality of openings 61, 62 ... 68, each to receive a fuse

terminal such as 69 and located opposite to an inner housing (similar to that of the case 44 in Figure 6), not shown, which is to receive a cable termination through a lower opening.

Only one of these terminations, shown at 70 and intended to confront the opening 61, is shown in the Figure.

Those terminations which are to confront the openings 62, 63, 66, 67 and all connected together, are formed in pairs from a one-piece element which provides the uninterrupted parallel between the terminations 71, 72 and 73, 74, respectively.

The connection element between the terminations 75, 76, respectively, is bent to an "L" and provided with an opening 77, 78 adapted to receive a clamp screw 79 which co-operates with a nut 80, having a thread-out preventing gasket, to firmly clamp the two connection elements 75, 76 together and to an eyelet cable termination 81.

These may also be one-piece constructions.

The cable termination 81 is preferably soldered to the cable 82 and protected by a heat-shrinkable sleeve excepting at the end eyelet.

The cable terminations such as 70 or paralleling element terminations such as 71, 72, 73, 74 are irreversibly inserted into the body 60 and isolated by the latter from one another.

To securely lock the terminations inside the body 60, housings are provided for locking elements such as 83 of the type described, inserted into the body 60 through the openings 84, 85, 86, 87.

In a side-by-side arrangement of the terminations, a single locking element can lock two terminations.

An upper cover 88 provided with snap engagement devices and a sealing gasket, not shown, provides protection for the fuses, and once applied, also ensures their correct positioning.

Likewise, a lower cover 89 provided with devices for engagement with the body 60 protects the cable terminations and the paralleling elements.

The foregoing description only covers a preferred embodiment of the invention, and it should be understood that many modifications and different combinations of fixed and movable terminations may be provided without departing from the invention scope.

In particular, fuse carrier assemblies may be provided wherein one or more cable terminations, as protected by cases like those shown in Figure 6, are removable, whereas other terminations, as provided with paralleling elements (such as 75, 76) for example, are fixed.

In this case, the lower cover for enclosing and protecting the terminations may be suitably shaped not to enclose the removable terminations, which can then be removed without removing the cover.

Claims

1. A protective arrangement against current overloading, comprising a fuse carrying box (60,88,89) and at least one cable termination (70) crimped and/or soldered to one cable end, said termination (70) being effective to provide electric contact with a fuse (69) terminal and being housed within said fuse box (60,88,89).

2. A protective arrangement as in Claim 1, wherein said termination (70) is housed fixedly within said box (60).

3. A protective arrangement as in Claim 2, wherein said termination (70) is locked within said box by elastic engagement means (47,48) which are prevented from becoming deformed by locking means (45,83) inserted into said box.

4. A protective arrangement as in Claim 1, wherein said termination (70) is contained inside an insulating protection case (44) housed removably within said box (60).

5. A protective arrangement as in Claim 1, comprising a plurality of said cable terminations (70) and a plurality of terminations (71,72) of contact with corresponding fuse terminals formed by a one-piece connection element (77) and means of securing (79,80,81) and electrically connecting said one-piece element (75) to at least one electric cable.

6. A protective arrangements as in the preceding claims, wherein said cable terminations (70) and/or contact terminations (71,72) comprise a prismatic conductive element having a contact comb (30) opposite to a contact wall (27) to establish at least a triple contact with at least a contact spot and a pair of contact spots, on opposed faces of a flat fuse terminal, and a mechanical element (37) fast with said prismatic conductive element and provided with an elastic comb (38) juxtaposed to said contact comb (30) for imposing a contact pressure through the contact comb (30) and said contact wall (27).

7. A protective arrangement as in Claim 6, wherein said cable termination (43) is provided with engagement means (41) and inserted into an insulating prismatic case (44) provided with elastic means (47,48) co-operating with said engagement means (41) to prevent withdrawal of said cable termination (43) from said case (44), said case (44) comprising a housing (52)

for a locking element (45) effective to inhibit elastic deformation of said elastic means (47,48).

8. An arrangement as in Claim 7, wherein said case (44) is integral with said box (60).

9. A protection arrangement as in Claim 7, wherein said insulating case (44) is inserted removably into said box (60) and provided with keyed insertion means (57) to prevent said case (44) from being inserted the wrong way up.

10. A protective arrangement as in Claim 9, wherein said insulating case (44) is provided with engagement means (56) co-operating with corresponding engagement means of said box (60) to prevent said case from being withdrawn from said box.

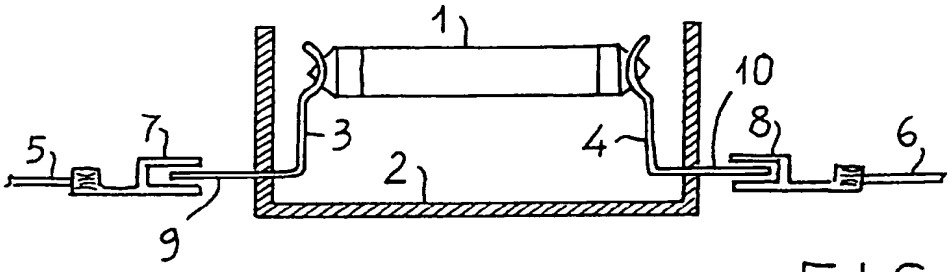

FIG.1

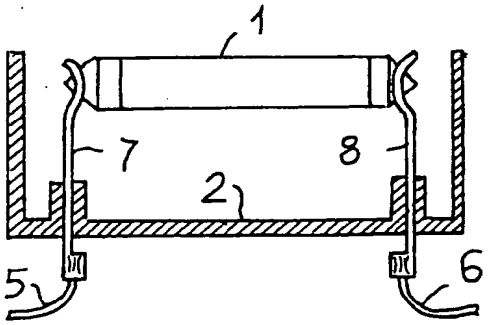

FIG.2

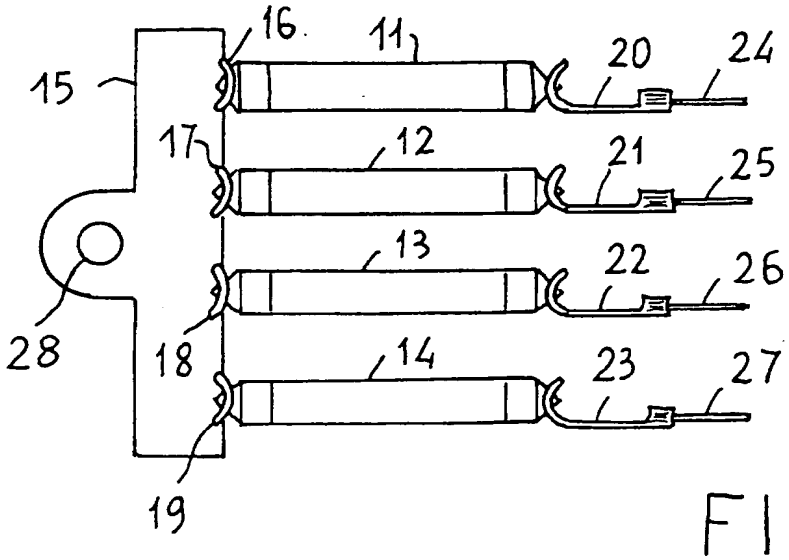

FIG.3

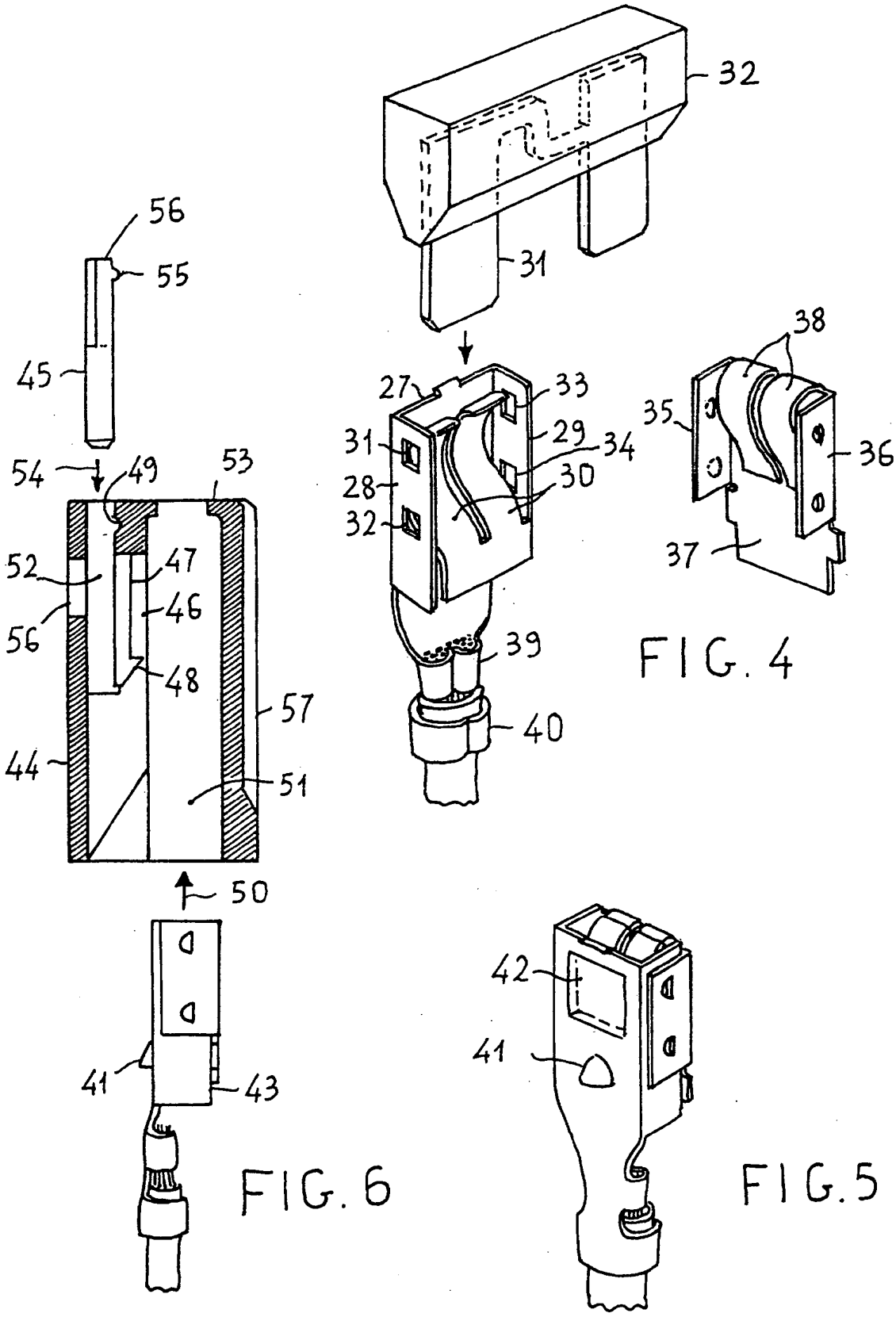

FIG. 4

FIG. 6

FIG. 5

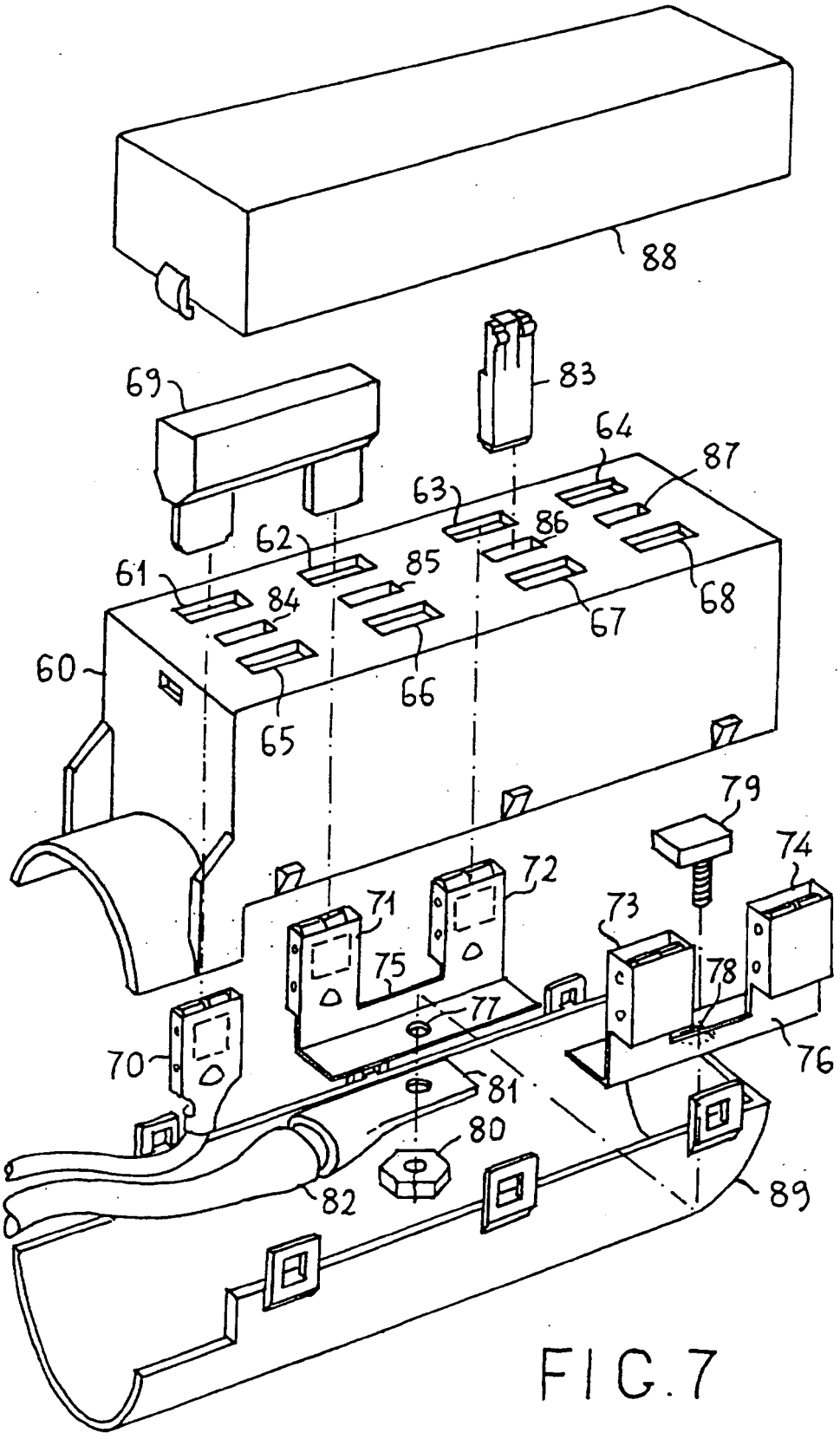
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FIG.7

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EUROPEAN SEARCH REPORT

Application Number
EP 93 20 3711

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	US-A-4 238 140 (TH. M. CAIRNS ET AL.) * column 3, line 54 - column 5, line 55; figures 1-9 *	1-6	H01H85/20
A		9,10	
X	DE-B-23 58 314 (KABELWERKE REINSHAGEN GMBH) * column 3, line 20 - column 4, line 23; claim 1; figures 1-3 *	1,2,7,8	
A		6	
X	FR-A-2 210 003 (RIST'S WIRES & CABLES LIMITED) * the whole document *	1,2,5	
A		7,8	
X	DE-U-89 02 868 (KAO,KUN-YAO) * page 5, paragraph 2; figures 1-4 *	1,2	
A		7,8	
P,X	US-A-5 257 951 (YUJI MAEDA) * column 1, line 6 - line 20 * * column 5, line 41 - column 7, line 20; figures 1-7 *	1-3,8	TECHNICAL FIELDS SEARCHED (Int.Cl.5) H01H B60R
P,A		6,7	
A	DE-U-80 28 942 (H. STRIBEL KG) * page 7, paragraph 2 - page 8, paragraph 1 * * page 11, paragraph 2 - page 13, paragraph 1; figures 1-3 *	1	
A	EP-A-0 356 106 (MOLEX INCORPORATED) * abstract; figures 1,15 *	1,2,5,8	
A	EP-A-0 508 059 (MECCANOTECNICA CODOGNESE S.P.A.) * claims 1,6; figure 1 *	1-3,7,8	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	14 September 1994	Ruppert, W

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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